

# Carbon Nanotube Modified Gas Diffusion Layer for PEM Fuel Cells

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## Abstract

Carbon nano-materials were applied to the gas diffusion layers of PEMFC. Gas diffusion layers consist of gas diffusion medium (carbon cloth or carbon paper) and micro-layers. Carbon actives have been widely used for the micro-layers. Main functions of gas diffusion layers are distribution of reactants to the active site of electrode, management of water supplied and/or generated and enhancement of electrical contact between the electrode and the bipolar plates. In this work, nano-tubes are adopted to the micro-layer of gas diffusion layers. The micro-porous layer of the GDLs as seen under scanning electron microscope showed excellent surface morphology showing the reinforcement with nano-tubes and the surface homogeneity without any cracks. In this work, the 50% of carbon nano tube and 50% of carbon active contained micro-layer case showed the best I-V performance. By applying nano-materials, thinner micro-layers can be fabricated. This newly made micro-layer showed higher gas permeability and good electric conductivity with similar degree of water management as well as enhanced performance.

**Keywords:** Proton Exchange Membrane Fuel Cell, Gas Diffusion Layer, Micro Porous Layer, Carbon Nanotubes



## Feasibility of Utilizing CHP Systems in Reduction of CO<sub>2</sub> Generation in Residential Units

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## Abstract

In this paper the application of CHP systems in reduction of energy consumption as well as CO<sub>2</sub> generation has been evaluated. A residential tower and an apartment have been considered as case studies. CHP system has been selected based on two scenarios (heat and power demand base) for both cases. The results show that the energy consumption as well as CO<sub>2</sub> generation decrease when CHP has been designed based on power demand, while the fixed cost increases. In this case, CHP systems with capacity of 10 and 700 kilowatt are adequate for an apartment and residential tower respectively. Meanwhile the results show that in the second scenario (heat demand) the fixed cost decreases while energy consumption and CO<sub>2</sub> will increase.

**Keywords:** CHP System, Synchronic Production, Increasing Efficiency, Energy Consumption, Decreasing Pollutants

## New Strategies in Cleaning of Ultrafiltration Membrane Using in Iran Dairy Industries

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### Abstract

Ultrafiltration (UF) is one of the membrane processes has the most applications in dairy industries such as milk dehydration and whey concentration. Fouling of UF membranes in the milk industry is mostly due to precipitation of microorganisms, proteins, fats and minerals on the membrane surfaces. Thus, chemical cleaning of the membranes is essential. Results from investigations on a polysulfone UF membrane fouled by precipitation of milk components are presented. The effect of different cleaning agents on recovery of the fouled membrane was studied. Results showed that a combination of sodium dodecyl sulfate, EDTA and sodium hydroxide could be used as a cleaning material to reach an optimum recovery of the membrane used for milk dehydration. It seems that the results obtained on an experimental scale can be applied to an industrial scale, and the method is able to overcome fouling on any scale.

**Keywords:** Ultrafiltration, Fouling, Chemical Eleaning, Membrane Recovery, Resistance Removal



## CO<sub>2</sub> Absorption by Aqueous NaOH Solution in Packed Column: Mass Transfer Coefficient and Absorption Rate

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### Abstract

Gas absorption process with chemical reaction by liquid solvents is widely used in the treatment of acid gases and gas purification. In this study, CO<sub>2</sub> chemically absorption experiments by aqueous solution of sodium hydroxide (NaOH) have been done in a packed column with Raschig Ring packings. Results are used for determination of CO<sub>2</sub> absorption rate and volumetric overall mass transfer coefficient ( $K_{Ga}$ ). Generally, the volumetric overall mass transfer coefficient ( $K_{Ga}$ ) for CO<sub>2</sub>-NaOH system is function of the process main operating parameters such as liquid volumetric flux, input gas phase mole fraction of CO<sub>2</sub>. Also, these experiments indicated that the overall mass transfer coefficient is enhanced by doubling of liquid volumetric flux and solvent concentration in average of 90% and 70%, respectively. Although, CO<sub>2</sub> absorption rate is raised by increasing of liquid flow rate and solvent concentration (doubling of each of them), up to 67% and 65%, respectively

**Keywords:** Absorption Rate, CO<sub>2</sub>, Volumetric Overall Mass Transfer Coefficient, Absorption Packed Column

## The Evaluation of Problems Encountered in Radioactive Materials Calorimetry

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### Abstract

Since the discovery of radioactivity in 1986, by Henry Becquerel, scientific interest has spurred study of the properties of radioactive materials. There are approximately 20 radioactive element and also occur in significant quantities in nature (excluding the fission products and transuranic generated by natural fission reactor). Radioactive materials decay by emission of alpha, beta or gamma rays. Calorimetry is the quantitative measurement of heat. Applications of calorimetry include measurements of the specific heats of elements and compounds, phase change enthalpies, and the rate of heat generation from radionuclides. Calorimetry is used as a nondestructive assay (NDA) technique for determining the power output of heat-producing nuclear materials. In performing calorimetry with radioactive materials, there are essentially two major problems: decay heat effects and protection of the calorimetrist from exposure to radioactivity. In the present study these aspects of calorimetry is discussed.

**Keywords:** Calorimetry, Radioactive Materials, Decay-Heat, Radiation Safety



## Characterization of Nanopores Ordering in Anodic Alumina with Image Processing Techniques

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### Abstract

Image processing techniques are recently employed in chemical engineering problems to evaluate and quantify result of experiments. Some of the most applications of image processing are the fabrication process of nanowires, membranes and catalysts. A new method to identify domains and quantify ordering degree of SEM micrographs of anodic porous alumina is presented in this paper. This method begins by take SEM micrographs from pores and identifying their centers, then their neighbors are detected and hexagons are identified. Then based on the configuration of neighboring pores an angel is assigned to the central pore of the hexagon. A spreading algorithm is proposed based on concatenating neighboring pores so that the standard deviations of angels of the whole domain do not exceed a specific threshold. Domain sizes are used as quantification criteria for anodic oxide aluminum ordering. Using the proposed technique proper anodization time to develop optimum domains in different anodization conditions could be achieved. Our algorithm greatly excels previous approaches identifying domain borders.

**Keywords:** Anodic Aluminum Oxide, Degree of Ordering, Nanostructures, Image Processing

# The Effect of Fuel Cell Operational Conditions on the Water Content Distribution in the Polymer Electrolyte Membrane

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## Abstract

*Models play an important role in fuel cell design and development. One of the critical problems to overcome in the proton exchange membrane (PEM) fuel cells is the water management. In this work a steady state, two dimensional, isothermal model in a single PEM fuel cell using individual computational fluid dynamics code was presented. Special attention was devoted to the water transport through the membrane. The effect of current density variation distribution on the Water content ( $\lambda$ ) in membrane/electrode assembly (MEA) was determined. Our simulation results show the reduction of reactant concentration in flow channels has a significant effect on electrochemical reaction in the gas diffusion and catalyst layer. Different fluxes are compared to investigate the effect of operating condition on the water fluxes in membrane. The model can be used for comparison of different polymer membrane performance. The model prediction of water content curves are compared with one dimensional model predictions data reported in the validated open literature and a good compatibility were observed.*

**Keywords:** Fuel Cell, Polymer Electrolyte Membrane, Modeling, Water Content



# Waste Electric and Electronic Equipment (WEEE) a Valuable Source to Recycle

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## Abstract

*The increasing production and rapid changes of electric and electronic equipments as well as their short useful life have created a large stream of waste electric and electronic equipment (weee). Although there are some disposal and burning methods to manage e-waste, these conventional methods have several economical and environmental disadvantages. E-wastes are composed of many different materials and their component make up is relatively complicated. Moreover reported data from different organizations shows the increasing amount of waste stream. As a result it is necessary to have an appropriate infrastructure, a comprehensive program and an effective management to recycle electronic waste effectively. In recent years many countries and organizations have drafted legislation to improve the reuse, recycling and other forms of recovery in order to reduce the disposal of such wastes. Fortunately there have been effective measures in this field in our country Iran.*

*In this paper, we briefly study electronic waste stream in terms of materials and components and amount of waste, recycling process including general steps of the process, advantages, e-waste management, collection system and related environmental problems and also recycling measures and programs in Iran.*

**Keywords:** Waste Electric and Electronic Equipment (Weee), Recycle, Environmental

# The Importance of Observing Ethics in Preparing Scientific Reports

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## Abstract

*Observing ethics in preparing scientific reports are obligatory. Deliberate or unintentional carelessness results in unoriginal or worthless records. The aim of the current paper is clarifying the plagiarism details. In this work, three categories are tackled including: a) Violation the rights of authors of scientific studies, b) Violation the rights of colleagues, c) self-plagiarism. The ethics in preparing a scientific report and penalties introduced by IChE for plagiarism are mentioned. Finally, suggestions for stopping plagiarism are provided.*

**Keywords:** Plagiarism, Rights Violation, Scientific Reports, Conference, Journal, Paper